

INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

LE™ SERIES OIL - FIRED BOILER



As an ENERGY STAR® Partner, U.S. Boiler Co., Inc. has determined that the LE1 fired at the 0.60 GPH rate meets the ENERGY STAR guidelines for Energy efficiency established by the United States Environmental Protection Agency (EPA).

For service or repairs to boiler, call your heating contractor. When seeking information on boiler, provide Boiler Model Number and Serial Number as shown on Rating Label.

Boiler Model Number LE	Boiler Serial Number	Installation Date
Heating Contractor		Phone Number
Address		



IMPORTANT INFORMATION - PLEASE READ THIS PAGE CAREFULLY

1. THIS BOILER HAS LIMITED WARRANTIES, COPIES OF WHICH ARE PRINTED ON THE BACK COVER OF THIS MANUAL.
2. THIS BOILER IS SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOORING. BOILER CAN NOT BE INSTALLED ON CARPETING.
3. ALL BOILERS MUST BE INSTALLED IN ACCORDANCE WITH NATIONAL, STATE AND LOCAL PLUMBING, HEATING AND ELECTRICAL CODES AND THE REGULATIONS OF THE SERVING UTILITIES WHICH MAY DIFFER FROM THIS MANUAL. AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED BEFORE INSTALLATIONS ARE MADE.

IN ALL CASES, REFERENCE SHOULD BE MADE TO THE FOLLOWING STANDARDS:

USA BOILERS

- A. Current Edition of American National Standard ANSI/NFPA 31, "Installation of Oil Burning Equipment", for clearances between boiler, vent connector and combustible material.
- B. Current Edition of American National Standard ANSI/NFPA 211, "Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances", For Chimney requirements, type of venting material and clearances between vent connector pipe and combustible materials.
- C. Current Edition of American Society of Mechanical Engineers ASME CSD-1, "Controls and Safety Devices for Automatically Fired Boilers", for assembly and operations of controls and safety devices.

CANADA BOILERS

- A. Current Edition of Canadian Standards Association CSA B139, "Installation Code for Oil Burning Equipment", for recommended Installation Practices.
4. ALL HEATING SYSTEMS SHOULD BE DESIGNED BY COMPETENT CONTRACTORS AND ONLY PERSONS KNOWLEDGEABLE IN THE LAYOUT AND INSTALLATION OF HYDRONIC HEATING SYSTEMS SHOULD ATTEMPT INSTALLATION OF ANY BOILER.
 5. THE BOILER MUST BE CONNECTED TO AN APPROVED CHIMNEY IN GOOD CONDITION. SERIOUS PROPERTY DAMAGE COULD RESULT IF THE BOILER IS CONNECTED TO A DIRTY OR INADEQUATE CHIMNEY. THE INTERIOR OF THE CHIMNEY FLUE MUST BE INSPECTED AND CLEANED BEFORE THE START OF THE HEATING SEASON AND SHOULD BE INSPECTED PERIODICALLY THROUGHOUT THE HEATING SEASON FOR ANY OBSTRUCTIONS. A CLEAN AND UNOBSTRUCTED CHIMNEY FLUE IS NECESSARY TO ALLOW NOXIOUS FUMES THAT COULD CAUSE INJURY OR LOSS OF LIFE TO VENT SAFELY AND WILL CONTRIBUTE TOWARD MAINTAINING THE BOILER'S EFFICIENCY.
 6. READ THE LITERATURE ENCLOSED BY THE MANUFACTURER WITH THE VARIOUS ACCESSORY DEVICES. THESE ACCESSORY DEVICES MUST BE INSTALLED AND USED ACCORDING TO THE RECOMMENDATIONS OF THE MANUFACTURER.
 7. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO SEE THAT ALL CONTROLS ARE CORRECTLY INSTALLED AND ARE OPERATING PROPERLY WHEN THE INSTALLATION IS COMPLETED.
 8. FOR OPTIMUM PERFORMANCE AND SERVICEABILITY FROM THIS UNIT ADHERE TO THE FOLLOWING RECOMMENDATIONS:
 - A. DO NOT TAMPER WITH THE UNIT OR CONTROLS. Retain your contractor or a competent serviceman to assure that the unit is properly adjusted and maintained.
 - B. Clean Firetubes at least once a year - preferably at the end of the heating season to remove soot and scale. Inside of Combustion Chamber should also be cleaned at the same time.
 - C. Have Oil Burner and Controls checked at least once a year or as may be necessitated.

WARNING

THIS BOILER IS DESIGNED TO BURN NO. 2 FUEL OIL ONLY. DO NOT USE GASOLINE, CRANKCASE DRAININGS, OR ANY OIL CONTAINING GASOLINE. NEVER BURN GARBAGE OR PAPER IN THIS BOILER. DO NOT CONVERT TO ANY SOLID FUEL (I.E. WOOD, COAL) OR GASEOUS FUEL (I.E. NATURAL GAS, LP/PROPANE). ALL FLAMMABLE DEBRIS, RAGS, PAPER, WOOD SCRAPS, ETC., SHOULD BE KEPT CLEAR OF THE BOILER AT ALL TIMES. KEEP THE BOILER AREA CLEAN AND FREE OF FIRE HAZARDS. All boilers equipped with burner swing door have a potential hazard which can cause severe property damage, personal injury or loss of life if ignored. Before opening swing door, turn off service switch to boiler and disconnect two halves of Burner Swing Door Interlock wiring harness to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fastener completely and reconnect two halves of Burner Swing Door Interlock when service is completed.

CAUTION

This boiler contains controls which may cause the boiler to shut down and not restart without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

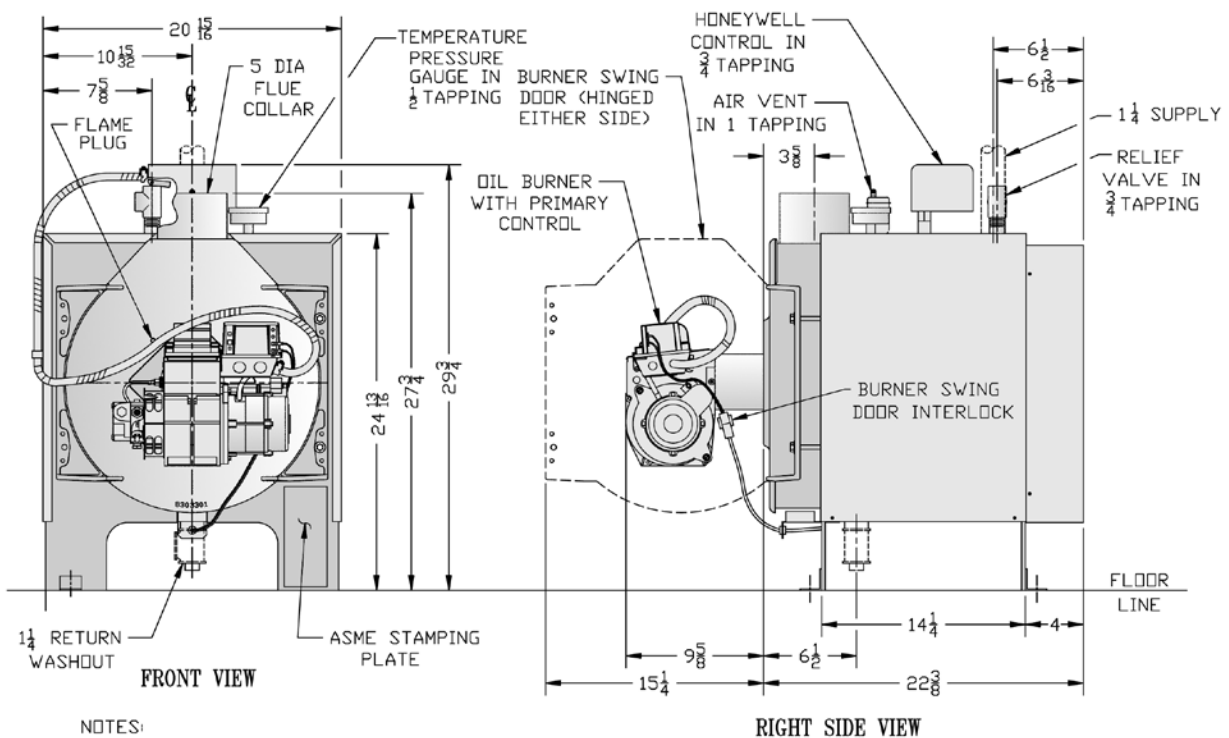
IMPORTANT

Before starting to install this oil boiler, read these instructions carefully. Keep instructions in legible condition and posted near oil boiler for reference by owner and service technician.

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I. General Information



Water Content: 6.1 Gallons

Figure 1: LE™ Packaged Boiler

1. **INSPECT SHIPMENT** carefully for any signs of damage.
 - A. ALL EQUIPMENT is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of crated Boiler to the carrier in good condition.
 - B. ANY CLAIMS for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances from, or shortage in orders, will be allowed by the manufacturer unless presented within sixty (60) days after receipt of goods.
Approximate shipping weight: 325 pounds
Water content: 6.1 gallons
2. **LOCATE BOILER** in front of final position before removing crate. See Figure 1.
 - A. LOCATE so that smoke pipe connection to chimney will be short and direct. BOILER IS SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOOR. Boiler can not be installed on carpeting.
 - B. FOR BASEMENT INSTALLATION, provide a solid base, such as concrete, if floor is not level or if water may be encountered on floor around Boiler.
 - C. PROVIDE SERVICE CLEARANCE of at least 24" clearance in front for servicing.
 - D. For minimum clearances to combustible materials See Figure 2.

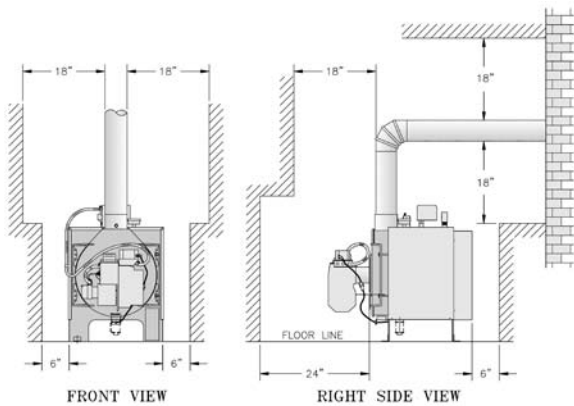


Figure 2: Minimum Installation Clearances To Combustible Materials

NOTE 1: Listed clearances comply with American National Standard ANSI/NFPA 31, Installation of oil burning equipment.

NOTE 2: LE Series boilers can be installed in rooms with clearances from combustible material as listed above. Listed clearances can not be reduced for alcove or closet installations.

NOTE 3: For reduced clearances to combustible material, protection must be provided as described in the above ANSI/NFPA 31 standard.

3. PROVIDE COMBUSTION AND VENTILATION AIR. Local code provisions may apply and should be referenced.

WARNING

Adequate combustion and ventilation air must be provided to assure proper combustion.

- A. Determine volume of space (boiler room). Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the space.

$$\text{Volume}(\text{ft}^3) = \text{Length}(\text{ft}) \times \text{Width}(\text{ft}) \times \text{Height}(\text{ft})$$
- B. Determine total input of all appliances in the space. Add inputs of all appliances in the space and round the result to the nearest 1000 BTU per hour.
- C. Determine type of space. Divide Volume by total input of all appliances in space. If the result is greater than or equal to $50 \text{ ft}^3/1000 \text{ BTU per hour}$, then it is considered an unconfined space. If the result is less than $50 \text{ ft}^3/1000 \text{ BTU per hour}$ then the space is considered a confined space.

- D. For boiler located in an unconfined space of a conventionally constructed building, the fresh air infiltration through cracks around windows and doors normally provides adequate air for combustion and ventilation.
- E. For boiler located in a confined space or an unconfined space in a building of unusually tight construction, provide outdoor air with the use of two permanent openings which communicate directly or by duct with the outdoors or spaces (crawl or attic) freely communicating with the outdoors. Locate one opening within 12 inches of top of space. Locate remaining opening within 12 inches of bottom of space. Minimum dimension of air opening is 3 inches. Size each opening per following:

- (1) **Direct communication with outdoors.**
 Minimum free area of 1 square inch per 4,000 BTU per hour input of all equipment in space.
- (2) **Vertical ducts.** Minimum free area of 1 square inch per 4,000 BTU per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.
- (3) **Horizontal ducts.** Minimum free area of 1 square inch per 2,000 BTU per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

Alternate method for boiler located within confined space. Use indoor air if two permanent openings communicate directly with additional space(s) of sufficient volume such that combined volume of all spaces meet criteria for unconfined space. Size each opening for minimum free area of 1 square inch per 1,000 BTU per hour input of all equipment in spaces, but not less than 100 square inches.

- F. Louvers and Grilles of Ventilation Ducts
 - (1) All outside openings should be screened and louvered. Screens used should not be smaller than 1/4 inch mesh. Louvers will prevent the entrance of rain and snow.
 - (2) Free area requirements need to consider the blocking effect of louvers, grilles, or screens protecting the openings. If the free area of the louver or grille is not known, assume wood louvers have 20-25 percent free area and metal louvers and grilles have 60-75 percent free area.

II. Installation Instructions

1. REMOVE CRATE

- Remove all fasteners at crate skid.
- Lift outside container and remove all other inside protective spacers and bracing. Remove container containing Safety Relief Valve, Boiler Drain Valve and Pipe Fittings.

2. REMOVAL OF BOILER FROM SKID

- Tilt boiler, "walk" boiler backward, and set rear legs down on floor. Tilt boiler backward, pull skid forward and set front legs down on edge of skid. Install close coupling, tee, and plug in return coupling, see Step 7 and Figure 1. Point tee toward permanent return location.
- Tilt boiler backward and remove skid. Be careful not to damage Burner and Jacket.

3. CHANGE HINGE POSITION if necessary.

- Look at the area where boiler will be installed. If left side of boiler will be less than 12 inches from a wall, move hinges to right side of boiler. See B through I below.
- Pull 2 halves of Burner Swing Door Interlock apart. Swing Door Interlock is connected to T-T terminals on R7184A Control. Lift Honeywell R7184A Control off of Burner Junction Box, open Burner Ignition Transformer and disconnect wiring harness from left side of burner. Find round plastic cover inside Junction Box and install in hole in left side of burner.
- Remove 8 sheet metal screws from jacket. Remove rear jacket box and bend both sides of Jacket Wrapper up, see Figure 19.

- Remove 2 (two) 5/16" - 18 x 3" long hex head cap screws and flatwashers from right side of door. Remove 2 hairpin cotter pins and 2 hinge pins from hinges on left side of door and remove Door Assembly from boiler. Inspect Front and Rear Door Insulation Pieces and Combustion Chamber Liner, see Step 6.
- Remove 4 hex nuts from bolts that attach hinges and hinge spacers to left side of Tubesheet. Remove 4 hex head cap screws that attach hinges to door.
- Attach 2 hinge brackets & spacers to Tubesheet and 2 hinge brackets to Door on right side of boiler. 3 Holes in each Hinge Bracket must line up with 3 matching holes in Spacer, Tubesheet or Door. See Figure 3. Tighten hex nuts, bolts and screws by hand only.
- Replace door assembly. Hinge brackets attached to door must rest on top of hinge brackets attached to tubesheet. See Figure 3. Slide hinge pins through hinges from top and install cotter pins. Close door and install 5/16" - 18 x 3" long hex head cap screws through flatwashers and left side of door and into tapped holes in tubesheet. Tighten all hex nuts, bolts and screws. When door is installed properly, it is parallel to Tubesheet when viewed from top and sides.
- Bend sides of Jacket Wrapper down and attach 2 Jacket Straps to 4 slots at bottom of Jacket Wrapper sides with sheet metal screws. Install Rear Jacket Box with 4 sheet metal screws. See Figure 19.
- Connect wiring harness to a knockout on right side of Junction Box and install Honeywell R7184A Control, see Wiring Diagram, Figures 11A and 11B. Reconnect Swing Door Interlock.

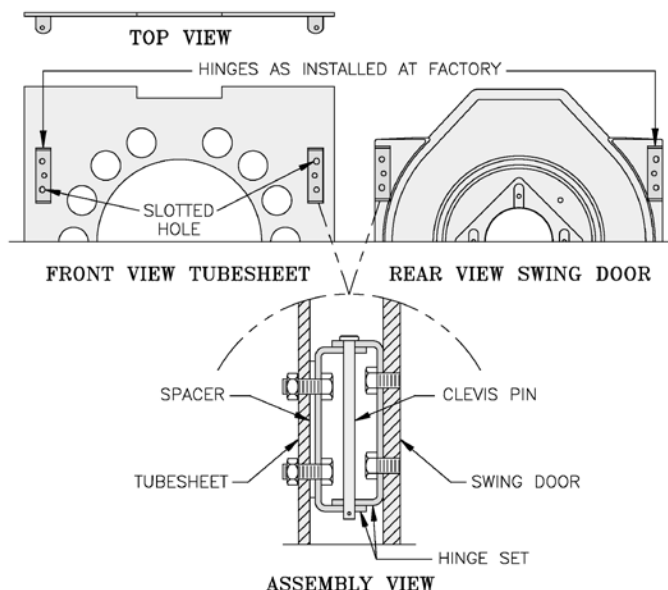


Figure 3: Hinge Installation & Assembly, LE Boiler

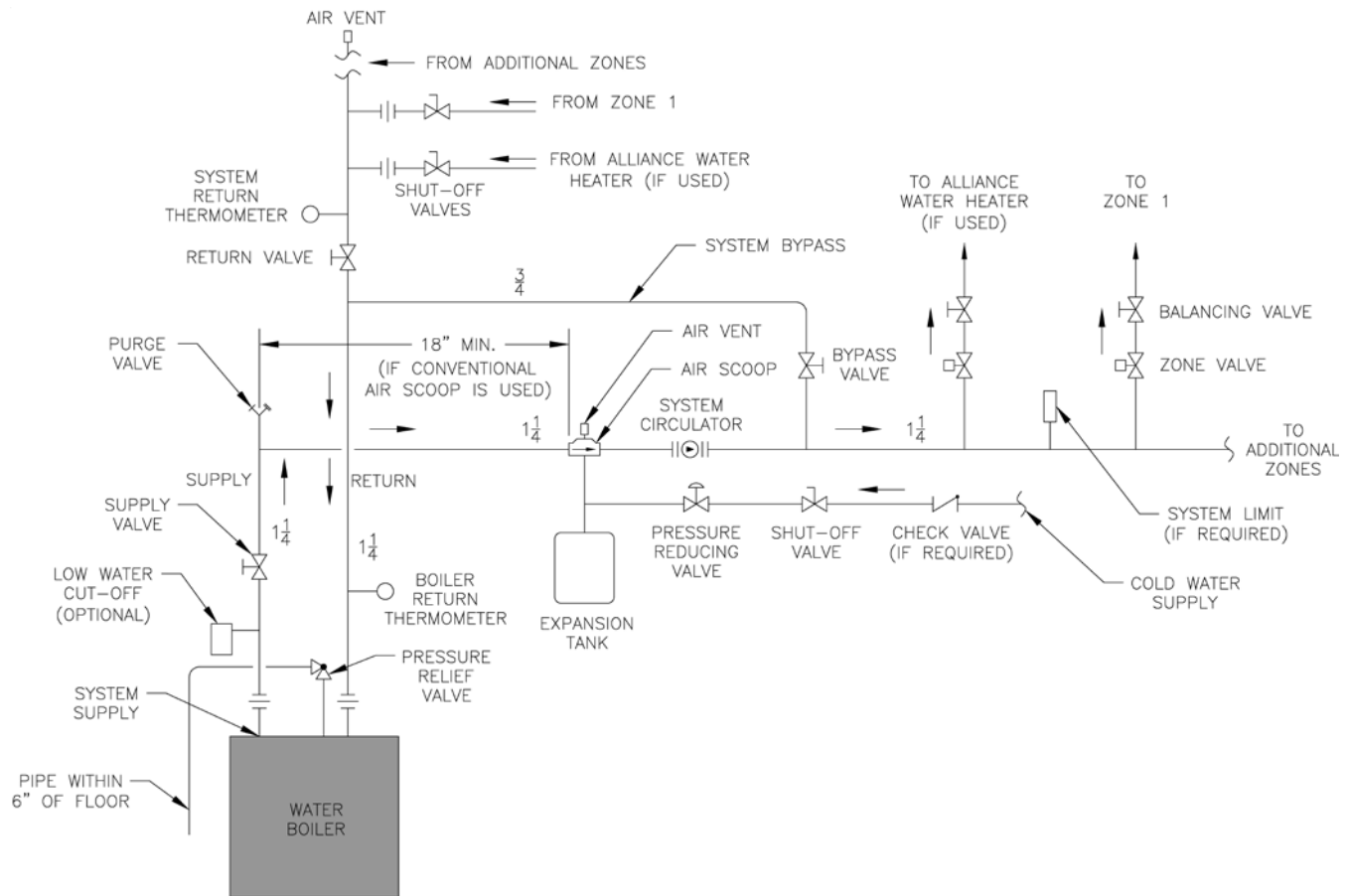


Figure 4: Recommended Water Piping for Zone Valve Zoned Heating Systems

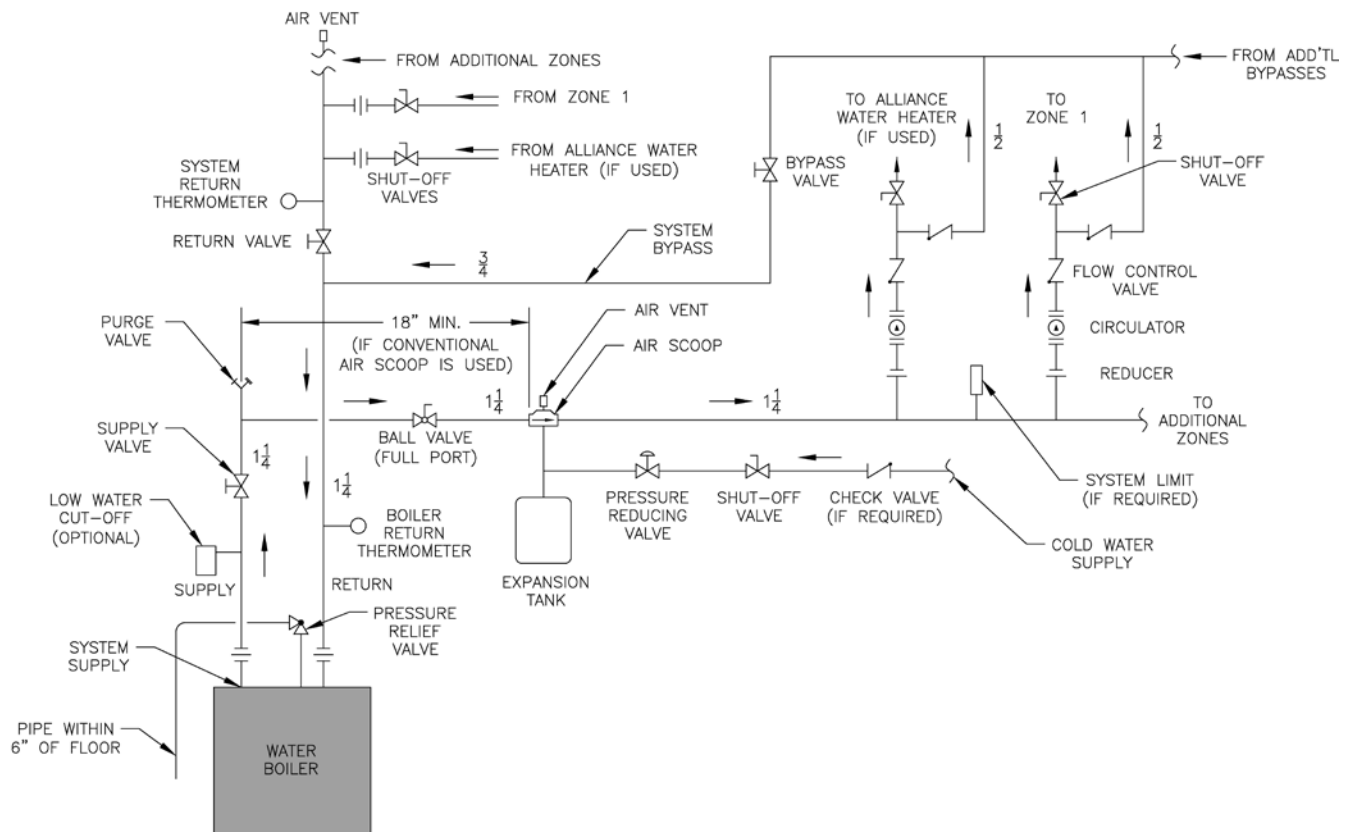


Figure 5: Recommended Water Piping for Circulator Zoned Heating Systems

4. INSTALL BOILER CONTROL.
 - A. Pull bulb and capillary tube out of hole in back of control. Insert bulb in immersion well on top of boiler and secure control with set screw in control.
 - B. Secure flexible conduit to Jacket Wrapper side with conduit clamp and sheet metal screw. Conduit must be on same side of boiler as Swing Door hinges.
5. MOVE BOILER TO PERMANENT POSITION by sliding or walking.
6. INSPECT FRONT AND REAR DOOR INSULATION PIECES AND COMBUSTION CHAMBER LINER
 - A. OPEN SWING DOOR on front of boiler. Use flashlight to inspect insulation pieces secured to front and rear doors. Inspect Ceramic Fiber Blanket secured to bottom of combustion chamber with water glass adhesive. Replace any damaged pieces.
7. CONNECT SUPPLY AND RETURN PIPING TO HEATING SYSTEM

- A. Hot water pipes shall have clearances of at least $\frac{1}{2}$ " from all combustible construction.
- B. Use a system by-pass if the boiler is to be operated in a system which has a large volume or excessive radiation where low boiler water temperatures may be encountered (i.e. converted gravity circulation system, etc.).

Valves should be located in the by-pass and return line as illustrated in Figures 4 and 5 in order to regulate water flow for maintenance of higher boiler water temperature.

Set the by-pass and return valves to a half throttle position to start. Operate boiler until the system water temperature reaches its normal operating range.

Adjust the valves to maintain 180°F to 200°F boiler water temperature and greater than 120°F return temperature. Adjust both valves simultaneously. Closing the boiler return valve while opening the by-pass valve will raise the boiler return temperature. Opening the boiler return valve while closing the by-pass valve will lower the boiler return temperature.

- C. If this boiler is used in connection with refrigeration systems, the boiler must be installed so that the chilled medium is piped in parallel with the heating boiler using appropriate valves to prevent the chilled medium from entering the boiler, see Figure 6. Also consult I=B=R Installation and Piping Guides.
- D. If this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air the boiler piping must be equipped with flow control valves to prevent gravity circulation of boiler water during the operation of the cooling system.

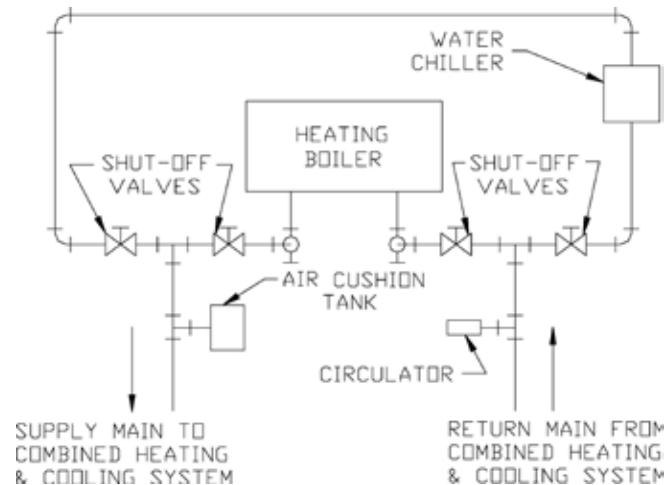


Figure 6: Recommended Piping for Combination Heating & Cooling (Refrigeration) Systems

- E. A hot water boiler installed above radiation level must be provided with a low water cutoff device as part of the installation.

If a low water cut-off is required, it must be mounted in the system piping above the boiler.

The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely.

- F. There are many possible causes of oxygen contamination such as:
 - (1) Addition of excessive make-up water as a result of system leaks.
 - (2) Absorption through open tanks and fittings.
 - (3) Oxygen permeable materials in the distribution system.

In order to insure long product life, oxygen sources should be eliminated. This can be accomplished by taking the following measures:

- (1) Repairing system leaks to eliminate the need for addition of make-up water.
- (2) Eliminating open tanks from the system.
- (3) Eliminating and/or repairing fittings which allow oxygen absorption.
- (4) Use of non-permeable materials in the distribution system.
- (5) Isolating the boiler from the system water by installing a heat exchanger.

CAUTION

Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure. Burnham's standard warranty does not cover problems caused by oxygen contamination of boiler water.

8. **INSTALL SMOKEPIPE** — The LE should be vented into a fireclay tile-lined masonry chimney or a chimney constructed from Type L Vent or a factory built chimney that complies with the Type HT requirement, of UL103. The chimney and vent pipe shall have a sufficient draft at all times, to assure safe proper operation of the boiler. See Figure 7 for recommended installation.

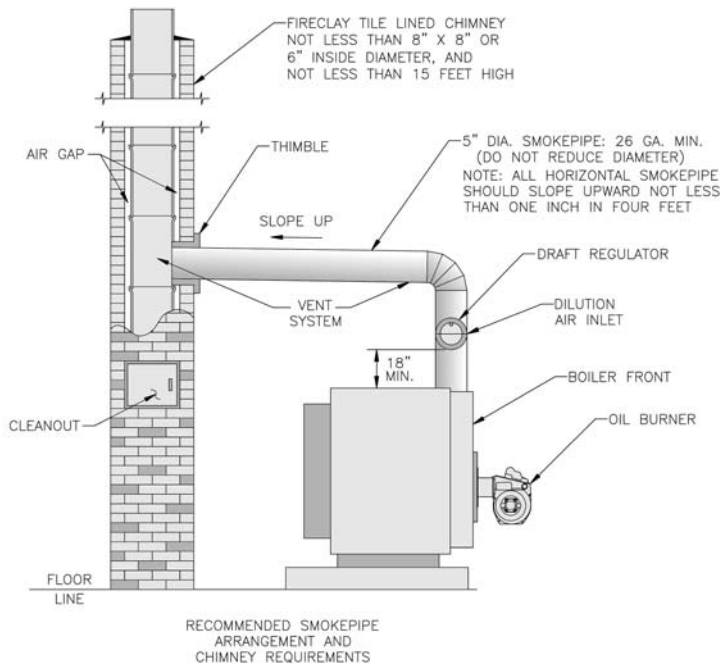


Figure 7

- A. Install the draft regulator following the instructions furnished with the regulator. See Figure 8 for alternate draft regulator locations.

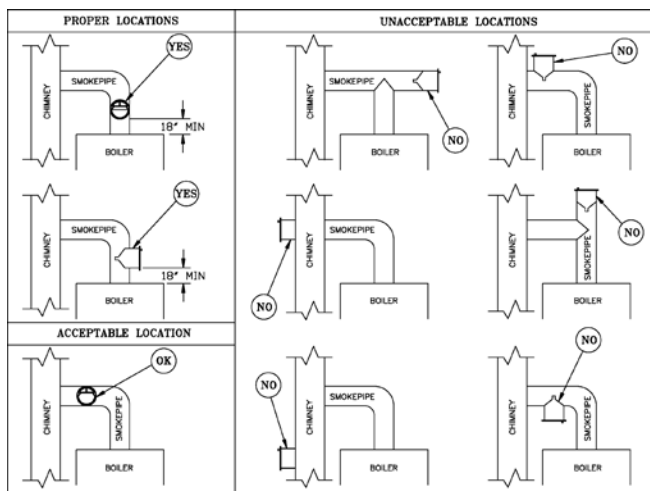


Figure 8

- B. Consider the chimney overall. Chimneys that have a high heat loss may become less suitable as the heat loss of the home goes down and the efficiency of the boiler installed goes up. Most homes have a chimney appropriate for the fuel and the era in which the home was built. That may have been a coal fired or an inefficient oil fired boiler built into

a home without insulation or storm windows. With increasing fuel prices that home probably has been insulated and fitted with storm windows so that the heat loss of the home has been reduced. This requires less fuel to be burned and sends less heat up the chimney.

A new boiler probably has a higher efficiency than the boiler being replaced. That probably means that the stack temperature from the new boiler will be lower than that from the old boiler and with less room air being drawn up the chimney to dilute the stack gases. The combination of a large uninsulated chimney, reduced firing rate, reduced firing time, lower stack temperature and less dilution air can, in some cases, contribute to the condensing of small amounts of water vapor in the chimney. Such condensation, when it occurs, can cause chimney deterioration. In extreme cases, condensed water may be visible on the outside of the breeching or chimney. In those extreme cases, the chimney may have to be lined to insulate the chimney and thus prevent the condensation. The addition of dilution air into the chimney may assist in drying the chimney interior surfaces.

- C. Heat extractors mounted into the breeching are not recommended.

9. INSTALL ELECTRIC WIRING

- A. Follow the National Electrical Code and local regulations. A separate electrical circuit must be run from the main electrical service with an over-current device/disconnect in the circuit. A service switch is recommended and may be required by some local jurisdictions. Wiring should conform to Figures 11A, 11B and 11C.
- B. CANADA — Refer to CSA standard C22.2 Part 1, 1990, Electrical Features of Fuel Burning Equipment (Gas and Oil).
- C. If boiler is installed in Canada, a blocked vent safety switch must be installed. Refer to Blocked Vent Safety Switch Instruction Supplement provided with boiler (Canada only).

10. FUEL UNITS AND OIL LINES

Use flexible oil line(s) so that Swing Door can be opened without disconnecting oil supply.

A supply line fuel oil filter is recommended as a minimum for all firing rates but a pleated paper fuel oil filter is recommended for the lowest (.6 GPH) firing rate application to prevent nozzle fouling.

SINGLE-PIPE OIL LINES — Standard burners are provided with single-stage 3450 rpm fuel units with the by-pass plug removed for single-pipe installations.

The single-stage fuel unit may be installed single-pipe with gravity feed or lift. Maximum allowable lift is 8 feet. See Figure 9.

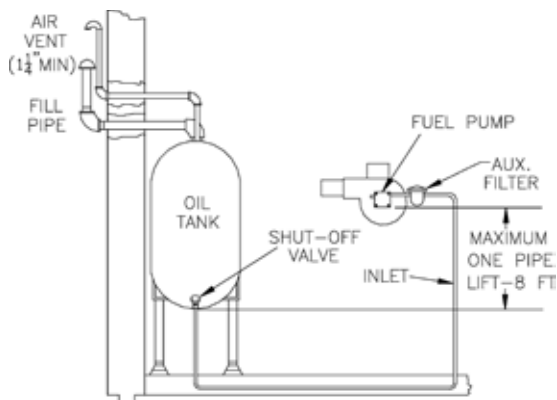


Figure 9

IMPORTANT

Single-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely.

TWO-PIPE OIL LINES - For two-pipe systems where more lift is required, the two-stage fuel unit is recommended. Tables 2 (single-stage) and 3 (two-stage) show allowable lift and lengths of 3/8-inch and 1/2-inch OD tubing for both suction and return lines. Refer to Figure 10.

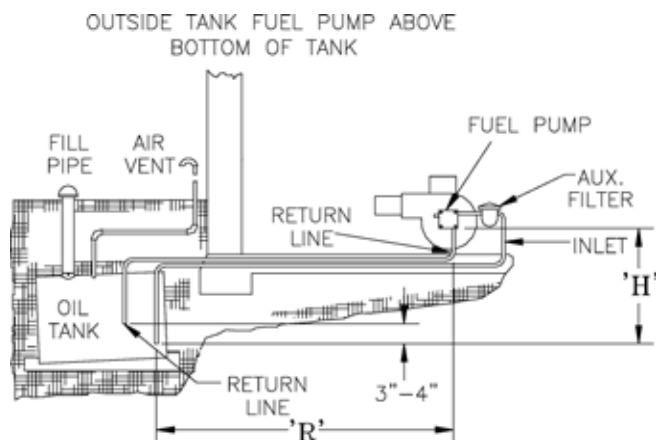


Figure 10

Be sure that all oil line connections are absolutely airtight.

Check all connections and joints. Flared fittings are recommended. Do not use compression fittings.

Open the air-bleed valve and start the burner. For clean bleed, slip a 3/16\" ID hose over the end of the bleed valve and bleed into a container. Continue to bleed for 15 seconds after oil is free of air bubbles. Stop burner and close valve.

**TABLE 2: SINGLE-STAGE UNITS (3450 RPM)
TWO-PIPE SYSTEMS**

Lift "H"	Maximum Length of Tubing "H" + "R"	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	84'	100'
1'	78'	100'
2'	73'	100'
3'	68'	100'
4'	63'	100'
5'	57'	100'
6'	52'	100'
7'	47'	100'
8'	42'	100'
9'	36'	100'
10'	31'	100'
11'	26'	100'
12'	21'	83'
13'	---	62'
14'	---	41'

**TABLE 3: TWO-STAGE UNITS (3450 RPM)
TWO-PIPE SYSTEMS**

Lift "H"	Maximum Length of Tubing "H" + "R"	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	93'	100'
2'	85'	100'
4'	77'	100'
6'	69'	100'
8'	60'	100'
10'	52'	100'
12'	44'	100'
14'	36'	100'
16'	27'	100'
18'	---	76'

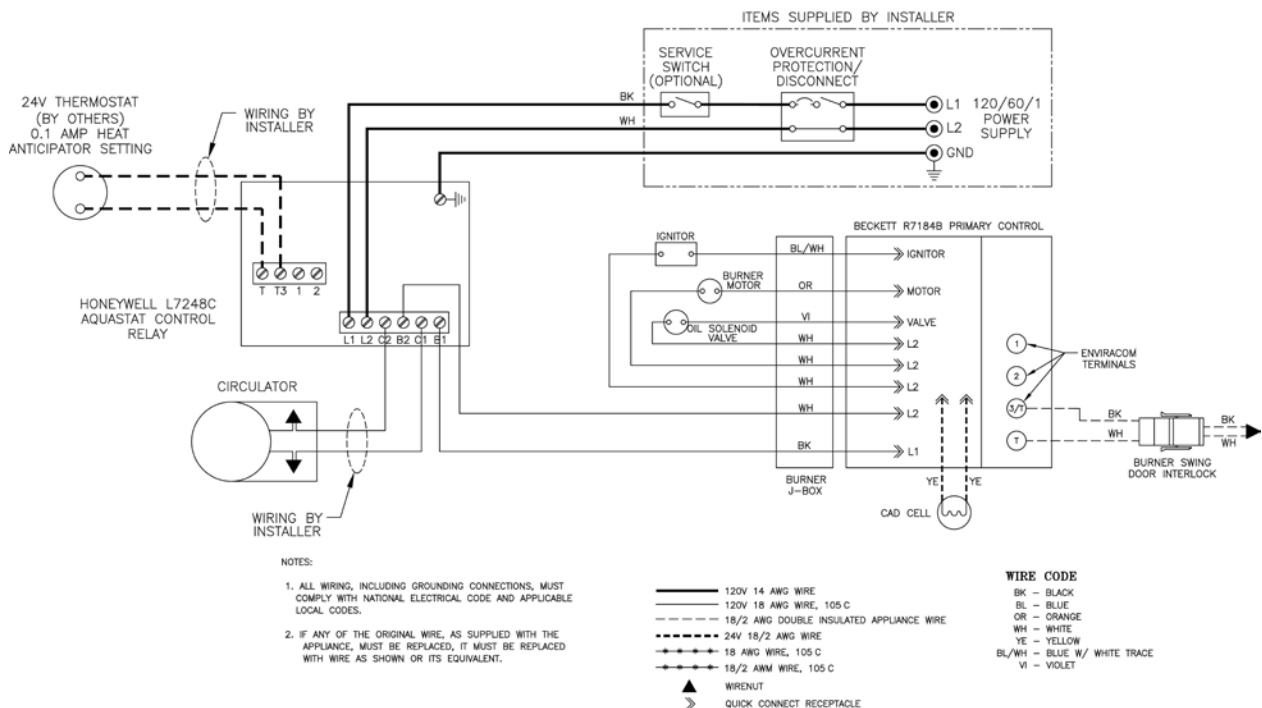


Figure 11A: Wiring Diagram for LE Boilers with Beckett AFG Burner and Split Controls

SEQUENCE OF OPERATION

A call for heat by the thermostat energizes the L7248C control which in turn energizes the R7184B primary control. The burner will initiate ignition after completing a 10 second pre-purge cycle. If burner ignites within approximately 45 seconds and the cad cell sees flame, the burner will continue to operate until the call for heat is satisfied or the setting of the high limit is reached. The circulator will operate as long as the thermostat is calling for heat. If the thermostat is not satisfied and the high limit is reached, the circulator will continue to operate, and the burner will stop until the high limit is closed by a drop in boiler water temperature.

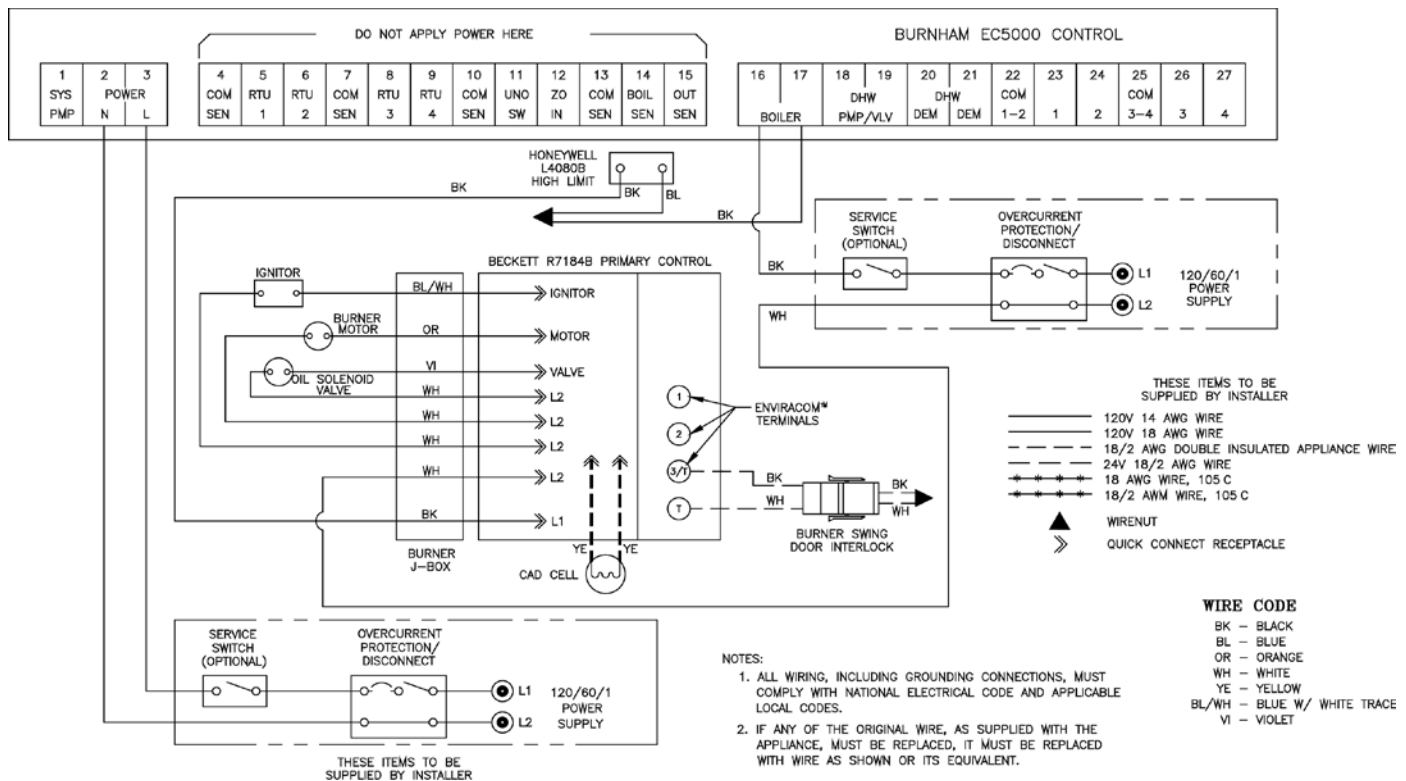


Figure 11B: Wiring Diagram for LE Boilers with Beckett AFG Burner, EC5000 Control, and Honeywell L4080B High Limit

SEQUENCE OF OPERATION

Refer to EC5000 Manual for wiring and operation details.

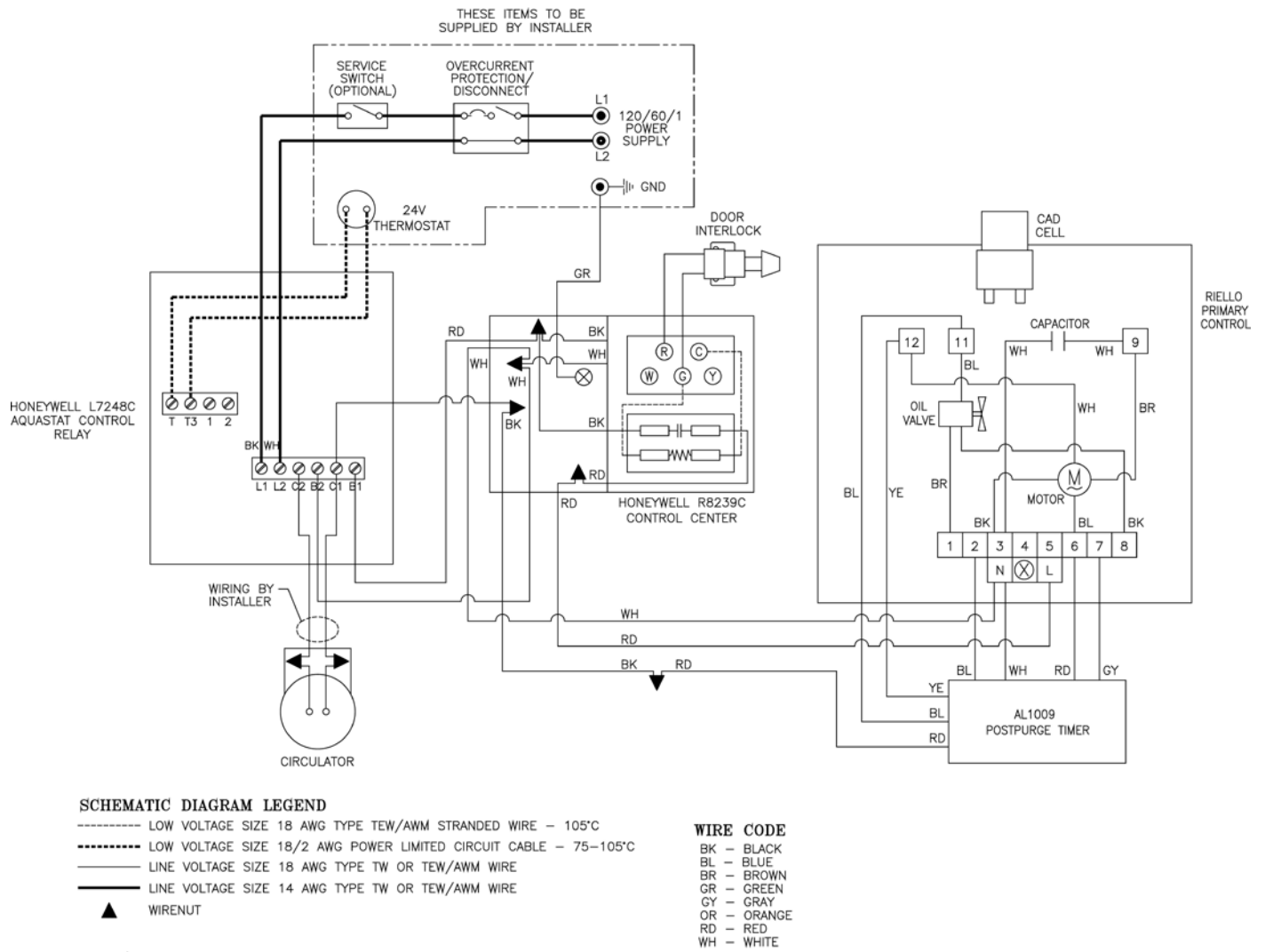


Figure 11C: Wiring Diagram for LE Boilers with Riello Burner

III. Operating and Service Instructions

WARNING

All boilers equipped with burner swing door have a potential hazard which can cause severe property damage, personal injury or loss of life if ignored. Before opening swing door, turn off service switch to boiler and disconnect two halves of Burner Swing Door Interlock wiring harness to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fastener completely and reconnect two halves of Burner Swing Door Interlock when service is completed.

1. ALWAYS INSPECT INSTALLATION BEFORE STARTING BURNER.

2. FILL HEATING SYSTEM WITH WATER.

NOTE: It is important to properly remove the oil and dirt from the system.

CLEAN HEATING SYSTEM If boiler water is dirty, refer to step 13 for proper cleaning instructions.

- A. Fill entire Heating System with water and vent air from system. Use the following procedure on a Series Loop or Multi-Zoned System installed as per Figures 4 and 5, to remove air from system when filling:

- (1) Close isolation valve in boiler supply piping.
- (2) Isolate all circuits by closing zone valves or balancing valves.
- (3) Attach a hose to hose bib located just below isolation valve in boiler supply piping.
(Note - Terminate hose in five gallon bucket at a suitable floor drain or outdoor area).
- (4) Starting with one circuit, open zone valve.
- (5) Open hose bib.
- (6) Open fill valve (Make-up water line should be located directly above isolation valve in boiler supply piping).
- (7) Allow water to overflow from bucket until discharge from hose is bubble free for 30 seconds.
- (8) Open zone valve to the second zone to be purged, then close the first. Repeat this step until all zones have been purged, but always have one zone open. At completion, open all zone valves.
- (9) Close hose bib, continue filling the system until the pressure gauge reads 12 psi. Close fill valve.

(Note - If make-up water line is equipped with pressure reducing valve, system will automatically fill to 12 psi. Leave globe valve open).

- (10) Open isolation valve in boiler supply piping.
- (11) Remove hose from hose bib.

3. CHECK CONTROLS, WIRING AND BURNER to be sure that all connections are tight and burner is rigid,

that all electrical connections have been completed and fuses installed, and that oil tank is filled and oil lines have been tested.

4. LUBRICATION — Follow instruction on burner and circulator label to lubricate, if oil lubricated. Most motors currently used on residential type burners employ permanently lubricated bearings and thus do not require any field lubrication. Water lubricated circulators do not need field lubrication.

Do not over-lubricate. This can cause as much trouble as no lubrication at all.

5. ADJUST CONTROLS SETTINGS with burner service switch turned "ON".
 - A. SET ROOM THERMOSTAT about 10° above room temperature.
 - B. PRESS RED RESET BUTTON.
 - C. On WATER BOILERS WITHOUT TANKLESS HEATERS equipped with **L7248** electronic aquastat controller, set High Limit (HL) at 180°F. This temperature can be varied to suit installation requirements. L7248 controller has the High Limit adjustment range from 180°F to 240°F (82°C to 116°C). High Limit Differential is fixed at 15°F (8°C).
 - D. ADJUSTING AQUASTAT CONTROLLER SETTINGS. To discourage unauthorized changing of Aquastat settings, a procedure to enter the **ADJUSTMENT** mode is required. To enter the **ADJUSTMENT** mode, press the **UP**, **DOWN**, and **I** buttons (refer to Figure 12) simultaneously for three seconds. Press the **I** button until the feature requiring adjustment is displayed:

- HL_ — High Limit.
- °F — °C.

Then, press the **UP** and/or **DOWN** buttons to move the set point to the desired value. After 60 seconds without any button inputs, the control will automatically return to the **RUN** mode.

L7248 Aquastat Controller **will not** display Low Limit and Low Limit Differential adjustment features.

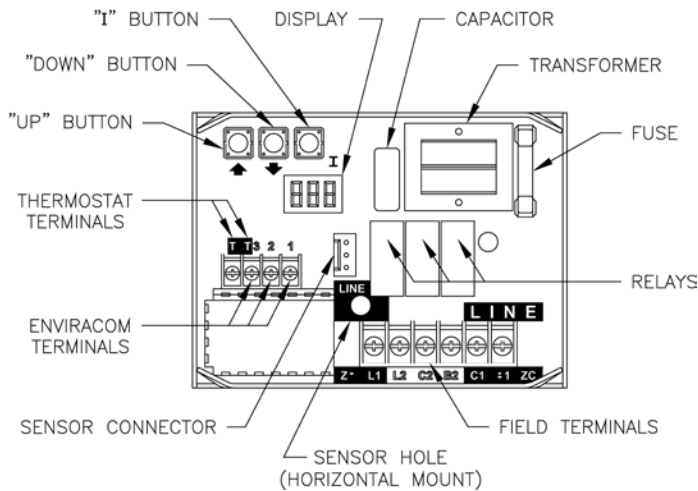


Figure 12: L7248 Circuit Board Layout - Horizontal Mount

E. DISPLAY READOUT

In the **RUN** mode, the Aquastat will flash "bt" (boiler temp) followed by the temperature (i.e., 220), followed by °F or °C.

To read boiler settings, press the **I** key to read the parameter of interest. For example, press **I** High Limit (**HL**) is displayed, followed by a three-digit number, i.e., 220, followed by °F or °C. See Display Readout, Figure 13.

Text	Description	Display Shows
<i>bt</i>	Boiler Temperature	bt
<i>HL</i>	High Limit	HL
<i>tt</i>	Local Thermostat Status	tt
<i>tte</i>	Enviracom Thermostat Status	tte
<i>err</i>	Error Code	Err
<i>f</i>	Degrees Fahrenheit	°F
<i>C</i>	Degrees Celsius	°C

Figure 13: Display Readout Definitions

After approximately 60 seconds without any key presses, the display will enter a dim display mode. To return to the bright display mode, simply press any key.

F. OPERATION

The L7248 model is restricted to three operational states - Normal, High Limit and Error. The controller moves back and forth from High Limit to Normal state as part of normal operation.

The controller will enter the Error state when there is an abnormal condition. The operating states are:

- (1) Normal: Boiler temperature went below the High Limit setting (minus the Differential) and has not exceeded the High Limit setting; or the boiler temperature went above the Low Limit

setting and has not gone below the Low Limit setting (minus the Differential).

- (2) High Limit: Boiler temperature went above the High Limit setting and has not dropped below the High Limit setting (minus the Differential).

TABLE 4: LED ERROR CODES

Error Code	Cause / Action
Err1	Sensor fault; check sensor.
Err2	ECOM fault; check EnviraCOM™ wiring.
Err3	Hardware fault; replace control.
Err4	B1 fault; check B1 wiring/voltage.
Err5	Low Line; check L1-L2, 110 Vac.
Err6	Fuse; check ECOM wires, replace fuse.
Err7	EEPROM, HL, Hdf; reset to default values. Restore desired settings.
Err8	Repeated B1 fault (voltage present at B1 when output is turned off); check B1 wiring/voltage.

- (3) Error: The controller has detected an error condition (e.g., open sensor) and has shut down

TABLE 5: L7248 CONTROLLER OPERATING SEQUENCE

Action	System Response
Thermostat calls for heat.	Circulator starts when water temperature is above Low Limit setting (if applicable). Boiler temperature is checked. Burner starts when water temperature is below High Limit setting.
Boiler exceeds the High Limit.	Burner is turned off. Burner restarts when the water temperature drops below the High Limit setting minus the Differential.
Thermostat is satisfied.	Circulator and burner turn off.
Error condition 1-5.	If an error condition is detected, all outputs except ZC are shut down. Burner is off. Control continues to function and restarts when error is corrected. During the error check sequence, the system checks for drift in the sensor and corrosion in the connections.
Error condition 6.	EnviraCOM communication is not available.
Error condition 7.	The control has reset the High Limit setting to a default setting and will continue to run at those settings. Performance of the system will be degraded.
Error condition 8.	If the error condition is detected, all outputs except ZC are shut down. Burner is off. Control continues to function and restarts when all three user keys have been pressed longer than 60 seconds.

the burner output. The ZC output is energized. The controller continues to monitor the system and automatically restarts if the error condition clears. Refer to Table 4.

The operating sequence for the L7248 is shown in Table 5.

G. HIGH LIMIT CONTROLLER

The High Limit opens and turns off the burner when the water temperature reaches the setpoint. The High Limit automatically resets after the water temperature drops past the setpoint and through the Differential. The L7248 models have High Limit Differential presets of 15°F (8°C). See Figure 14.

6. REMOVE GUN ASSEMBLY

LE Boilers equipped with Beckett AFG burners. Items to be checked are nozzle size, type, and angle; head size, (and setting on MD(V1) head); gun setting; and positioning of electrodes. This information is shown in Figure 15, and Table 6. If the desired boiler firing rate is 0.6 GPH, the nozzle must be changed out, the low firing rate baffle must be installed and the factory settings must be changed according to Table 6. These parts are in the bag attached to the burner. Reinstall gun assembly.

LE Boilers equipped with Riello 40 F3 and 40 F5 burners: Items to be checked are nozzle size, type and angle: settings (air gate, turbulator and pump pressure). This information is shown in Table 6A. Reinstall gun assembly.

7. ADJUST OIL BURNER BEFORE STARTING

- A. SET BURNER SETTINGS, see Tables 6 and 6A.
- B. OPEN ALL OIL LINE VALVES.

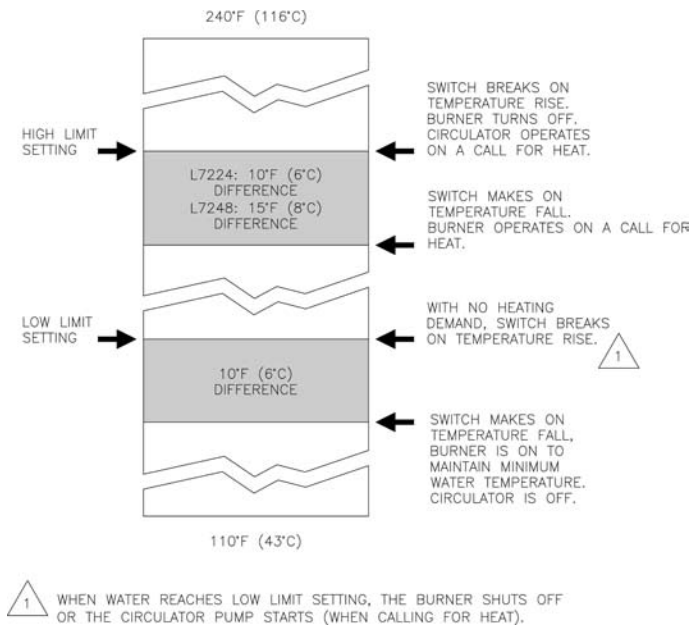


TABLE 6: BECKETT AFG BURNER

Boiler Model	Firing Rate (GPH)	Head	Static Disc	Nozzle				Settings			
				Manufacturer	GPH	Angle	Type	Air Shutter	Air Band	Head	Pump Pressure (PSIG)
LE1	0.60 *	MB(L1)	3-3/8U	Hago or Delavan	0.50	70°	B	5	0	N/A	140
LE2	1.00				0.85	60°	B	10	0	N/A	140
LE3	1.25 +	MD(V1)	2-3/4U	Delavan	1.10	45°	B	10	1.5	0	140

Settings are approximate and must be verified by Smoke and Carbon Dioxide measurement. Readjust where necessary.

See Text of the Manual.

* Install low firing rate baffle for 0.60 GPH firing rate.

+ Do not change the firing rate of the 1.25 GPH burner.

TABLE 6A: RIELLO BURNER SPECIFICATIONS

Boiler Model	Firing Rate (GPH)	Burner Model	Nozzle	Settings		
				Air Gate	Pump Pressure	Turbulator
LE1	0.60	F3	Delavan 0.50 x 60°A	2.8	145	0.5
LE2	1.00	F5	Delavan 0.85 x 60°A	3.0		1.0
LE3	1.25	F5	Delavan 1.00 x 60°A	3.5		3.0

C. Attach a plastic hose to fuel pump vent fitting and provide a pan to catch the oil.

D. REMOVE GAUGE PORT PLUG from fuel pump and install pressure gauge.

E. REMOVE FLAME PLUG IN SWING DOOR.

8. START OIL BURNER

A. Open vent fitting on fuel pump.

B. TURN 'ON' BURNER service switch and allow burner to run until oil flows from vent fitting in a SOLID stream without air bubbles for approximately 10 seconds.

C. Close vent fitting and burner flame should start immediately after pre-purge is complete. Pre-purge prevents burner flame until 10 seconds has elapsed after initial power is applied to burner. During pre-purge, the motor and ignitor will operate but the oil valve will remain closed. Refer to Oil Primary Control Instructions for more details.

9. ADJUST OIL PRESSURE

A. Locate oil pressure adjusting screw and turn screw to obtain the oil pressure indicated in Tables 6 and 6A.

B. DO NOT REMOVE PRESSURE GAUGE until later.

10. OTHER ADJUSTMENTS

A. ADJUST THE AIR BAND AND/OR AIR SHUTTER

Beckett Burners:

Adjust air supply by loosening lock screws and moving the air shutter and if necessary the air band. Refer to Table 6 for preliminary settings.

B. ADJUST DRAFT REGULATOR for a draft of 0 to maximum of -.03" (water gauge) in the breeching after chimney has reached operating temperature and while burner is running. Burner will operate with a positive draft over fire and zero draft in the breeching. Adjust Draft Regulator such that maximum draft of -.03" is reached in coldest weather.

C. READJUST AIR BANDS on burner for a light orange colored flame. Use a smoke tester and adjust air for minimum smoke (not to exceed #1) with a minimum of excess air. Make final check using suitable instrumentation to obtain a CO₂ of 11.5 to 12.5%. These settings will assure a safe and efficient operating condition. If the flame appears stringy instead of a solid fire, try another nozzle of the same type. Flame should be solid and compact. After all adjustments are made recheck for a draft of zero to -.03" (water gauge) in breeching.

D. TURN "OFF" BURNER and remove pressure gauge. Install gauge port plug and tighten. Start burner again.

E. CAD CELL LOCATION AND SERVICE

The burner is supplied with a cadmium sulfide flame detector mounted at the factory, mounted on the bottom of the transformer. See Figure 16. To service cad cell or to replace the plug in portion, swing open the transformer. After service is complete, be sure to fasten down the transformer.

F. FLAME FAILURE

The LE boiler controls operate the burner automatically. If for unknown reasons the burner ceases to fire and the reset button on the primary control has tripped, the burner has experienced ignition failure.

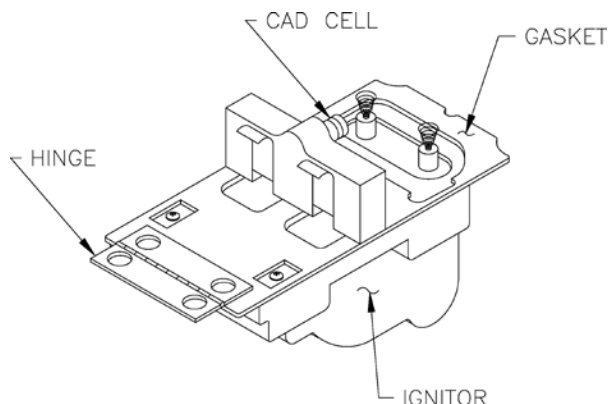


Figure 16: Cad Cell

Before pressing the reset button call your service-man immediately.

CAUTION

Do not attempt to start the burner when excess oil has accumulated, when the unit is full of vapor, or when the combustion chamber is very hot.

11. CHECK FOR CLEAN CUT OFF OF BURNER

- A. AIR IN THE OIL LINE between fuel unit and nozzle will compress when burner is on and will expand when burner stops, causing oil to squirt from nozzle at low pressure as burner slows down and causing nozzle to drip after burner stops. Usually cycling the burner operation about 5 to 10 times will rid oil line of this air.
- B. IF NOZZLE CONTINUES TO DRIP, repeat step (11A). If this does not stop the dripping, remove cutoff valve and seat, and wipe both with a clean cloth until clean, then replace and re-adjust oil pressure.

12. TEST CONTROLS.

WARNING

Before installation of the boiler is considered complete, the operation of the boiler controls should be checked, particularly the primary control and high limit control.

- A. CHECK THERMOSTAT OPERATION. Raise and lower thermostat setting as required to start and stop burner.
- B. VERIFY PRIMARY CONTROL SAFETY FEATURES using procedures outlined in instructions furnished with control or instructions below:

CAUTION

FOR HEATING SERVICEMAN ONLY

(1) Safe Start

- i. Jumper the yellow cad cell leads.
- ii. Follow procedure to turn on burner. Burner must not start, indicator light turns on and control remains in Idle Mode.

(2) Simulate Flame Failure.

- i. Follow procedure to turn on burner.
- ii. Close hand valve in oil supply line.
- iii. Device enters recycle mode.
- iv. Device tries to restart system after approximately 60 seconds.
- v. Safety switch locks out approximately in safety switch timing indicated on label. Indicator light flashes at 1 Hz rate. Ignition and motor stop and oil valve closes.

(3) Simulate Ignition Failure.

- i. Follow procedure to turn on burner, but do not open oil supply hand valve.
- ii. Observe that safety switch locks out approximately within safety switch timing as indicated on the label. Indicator light flashes at 1 Hz rate. Ignition and motor stop and oil valve closes.

(4) The indicator light on the oil primary control provides lockout, recycle and cad cell indications as follows:

- i. Flashing at 1 Hz (½ second on, ½ second off): system is locked out or in restricted mode.
- ii. Flashing at ¼ Hz (2 seconds on, 2 seconds off): control is in recycle mode.
- iii. On: cad cell is sensing flame.
- iv. Off: cad cell is not sensing flame.

- C. CHECK HIGH LIMIT CONTROL. Jumper thermostat terminals. Allow burner to operate until shut-down by limit. Installation is not considered complete until this check has been made.

REMOVE JUMPER.

IF CONTROLS DO NOT MEET REQUIREMENTS OUTLINED IN PARAGRAPH 12, REPLACE CONTROL AND REPEAT CHECK-OUT PROCEDURES.

13. BOILER AND SYSTEM CLEANING INSTRUCTIONS FOR TROUBLE FREE OPERATION

- A. *Filling of Boiler and System — General* — In a hot water heating system, the boiler and entire system (other than the expansion tank) must be full of water for satisfactory operation. Water should be added to the system until the boiler pressure gauge registers 12 psi. To insure that the system is full, water should come out of all air vents when opened. The LE boiler holds 6.1 gallons of water.

B. *Boiling Out of Boiler and System.* The oil and grease which accumulate in a new hot water boiler can be washed out in the following manner.

- (1) Remove Safety Relief Valve using extreme care to avoid damaging it.
- (2) Partially fill boiler and add caustic soda or trisodium phosphate. Add an appropriate amount of recommended boil out compound.
- (3) Replace Safety Relief Valve.
- (4) Fill the entire system with water.
- (5) Start firing the boiler.
- (6) Circulate the water through the entire system.
- (7) Vent the system, including the radiation.
- (8) Allow boiler water to reach operating temperature, if possible.
- (9) Continue to Circulate the water for a few hours.
- (10) Stop firing the boiler.
- (11) Drain the system in a manner and to a location that hot water can be discharged with safety.
- (12) Remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
- (13) Refill the system with fresh water.

C. Add appropriate boiler water treatment compounds as recommended by your qualified water treatment company.

D. *Make pH or Alkalinity Test.*

After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small hydrion dispenser gives the reading pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or thru your local druggist. The pH should be higher than 7 but lower than 11. Add appropriate water treatment chemicals, if necessary, to bring the pH within the specified range. With this lower level of protection, care must be exercised to eliminate all of the free oxygen in the system.

E. Boiler is now ready to be put into service.

IMPORTANT

IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD WATER MORE FREQUENTLY THAN ONCE A MONTH, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.

A leaky system will increase the volume of make-up water supplied to the boiler which can significantly

shorten the life of the boiler. Entrained in make-up water are dissolved minerals and oxygen. When the fresh, cool make-up water is heated in the boiler the minerals fall out as sediment and the oxygen escapes as a gas. Both can result in reduced boiler life. The accumulation of sediment can eventually isolate the water from contacting the steel. When this happens the steel in that area gets extremely hot and eventually cracks. The presence of free oxygen in the boiler creates a corrosive atmosphere which, if the concentration becomes high enough, can corrode the steel through from the inside. Since neither of these failure types are the result of a manufacturing defect the warranty does not apply. Clearly it is in everyone's best interest to prevent this type of failure. The maintenance of system integrity is the best method to achieve this.

14. HINTS ON COMBUSTION

A. **NOZZLES** — Although the nozzle is a relatively inexpensive device, its function is critical to the successful operation of the oil burner. The selection of the nozzle supplied with the LE boiler is the result of extensive testing to obtain the best flame shape and efficient combustion. Other brands of the same spray angle and spray pattern may be used but may not perform at the expected level of CO₂ and smoke. Nozzles are delicate and should be protected from dirt and abuse. Nozzles are mass-produced and can vary from sample to sample. For all of those reasons a spare nozzle is a desirable item for a serviceman to have.

B. **FLAME SHAPE** — Looking into the combustion chamber through the flame plug hole, the flame should appear straight with no sparklers rolling up toward the top of the chamber. If the flame drags to the right or left, sends sparklers upward or makes wet spots on the rear door insulation piece, the nozzle should be replaced. If the condition persists look for fuel leaks, air leaks, water or dirt in the fuel as described below.

C. **FUEL LEAKS** — Any fuel leak between the pump and the nozzle will be detrimental to good combustion results. Look for wet surfaces in the air tube, under the transformer, and around the air inlet. Any such leaks should be repaired as they may cause erratic burning of the fuel and in the extreme case may become a fire hazard.

D. **AIR LEAKS** — Any such leaks should be repaired, as they may cause erratic burning of the fuel and in extreme cases may become a fire hazard.

There are many possible causes of air leaks in oil lines such as:

- (1) Fitting leaks due to mis-flared tubing or damaged fitting.
- (2) Fuel line leak due to crushed or bent tubing.
- (3) Filter connection leaks.

Important Product Safety Information

Refractory Ceramic Fiber Product

Warning:

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures about 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
 - Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

First Aid Procedures:

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

- (4) Tank connection leaks.

There are various test kits available to trace air leaks, such as electronic sight glasses. Follow the manufacturers' instructions to find air leaks.

The following actions can eliminate air leaks:

- (1) Bleed pump as detailed previously.
- (2) Replace flare fittings.
- (3) Replace oil supply line.
- (4) Repair oil filter leaks.
- (5) Replace or repair tank fittings.

IMPORTANT

CHECK TEST PROCEDURE. A very good test for isolating fuel side problems is to disconnect the fuel system and with a 2' length of tubing, fire out of an auxiliary five gallon pail of clean, fresh, warm #2 oil from another source. If the burner runs successfully when drawing out of the auxiliary pail then the problem is isolated to the fuel or fuel lines being used on the jobsite.

- E. GASKET LEAKS — If 11.5 to 12.5% CO₂ with a #1 smoke or less cannot be obtained in the breeching, look for air leaks around the flue collar. Such air leaks will cause a lower CO₂ reading in the breeching. The smaller the firing rate the greater effect an air leak can have on CO₂ readings.
- F. DIRT — A fuel filter is a good investment. Accidental accumulation of dirt in the fuel system can clog the nozzle or nozzle strainer and produce a poor spray pattern from the nozzle. The smaller the firing rate, the smaller the slots become in the nozzle and the more prone to plugging it becomes with the same amount of dirt.
- G. WATER — Water in the fuel in large amounts will stall the fuel pump. Water in the fuel in smaller amounts will cause excessive wear on the pump, but more importantly water doesn't burn. It chills the flame and causes smoke and unburned fuel to pass out of the combustion chamber and clog the flueways of the boiler.

- H. COLD OIL — If the oil temperature approaching the fuel pump is 40°F or lower poor combustion or delayed ignition may result. Cold oil is harder to atomize at the nozzle. Thus, the spray droplets get larger and the flame shape gets longer. An outside fuel tank that is above grade or has fuel lines in a shallow bury is a good candidate for cold oil. The best solution is to bury the tank and lines deep enough to keep the oil above 40°F.

I. HIGH ALTITUDE INSTALLATIONS

Air settings must be increased at higher altitudes. Use instruments and set for 11.5 to 12.5% CO₂.

- J. START-UP NOISE — Late ignition is the cause of start-up noises. If it occurs recheck for electrode settings, flame shape, air or water in the fuel lines.
- K. SHUT DOWN NOISE — If the flame runs out of air before it runs out of fuel, an after burn with noise may occur. That may be the result of a faulty cut-off valve in the fuel pump, or it may be air trapped in the nozzle line. It may take several firing cycles for that air to be fully vented through the nozzle. Water in the fuel or poor flame shape can also cause shut down noises.

15. ATTENTION TO BOILER WHILE NOT IN OPERATION.

IMPORTANT

IF BOILER IS NOT USED DURING WINTER TIME, IT MUST BE FULLY DRAINED TO PREVENT FREEZE DAMAGE.

- A. Spray inside surfaces with light lubricating or crankcase oil using gun with extended stem so as to reach all corners.
- B. Always keep the manual fuel supply valve shut off if the burner is shut down for an extended period of time.
- C. To recondition the heating system in the fall season after a prolonged shut down, follow the instructions outlined in Section III — Operating and Service Instructions, Items 1 through 8.

IV. Boiler Cleaning

WARNING

All boiler cleaning must be completed with burner service switch turned off. Boilers equipped with burner swing door have a potential hazard which can cause severe property damage, personal injury or loss of life if ignored. Before opening swing door, turn off service switch to boiler to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fastener completely when service is completed.

1. CLEAN THE FIRETUBES

- A. For access to fireside of boiler, pull two halves of Burner Swing Door Interlock wiring harness apart, remove hex nuts holding door closed and open swing door.
- B. Prior to cleaning boiler, lay a protective cloth or plastic over combustion chamber liner.
- C. Using a 1 1/2" diameter wire brush (30" handle), clean firetubes. Measure 15" from end of brush opposite handle, and mark handle. DO NOT allow this mark to go past front end of firetube during cleaning, or brush will hit rear door insulation piece.

2. CLEAN THE COMBUSTION CHAMBER

Using wire or fiber bristle brush, clean inside of combustion chamber. DO NOT let brush hit rear door insulation piece or combustion chamber liner.

3. AFTER CLEANING

Vacuum debris inside bottom of rear door, remove protective cloth, and vacuum remaining fireside of boiler as necessary. BE CAREFUL not to damage liner or rear door insulation piece. Inspect front and rear door insulation pieces, front door gaskets and combustion chamber liner for damage. Replace any damaged pieces.

4. CLOSE BOILER

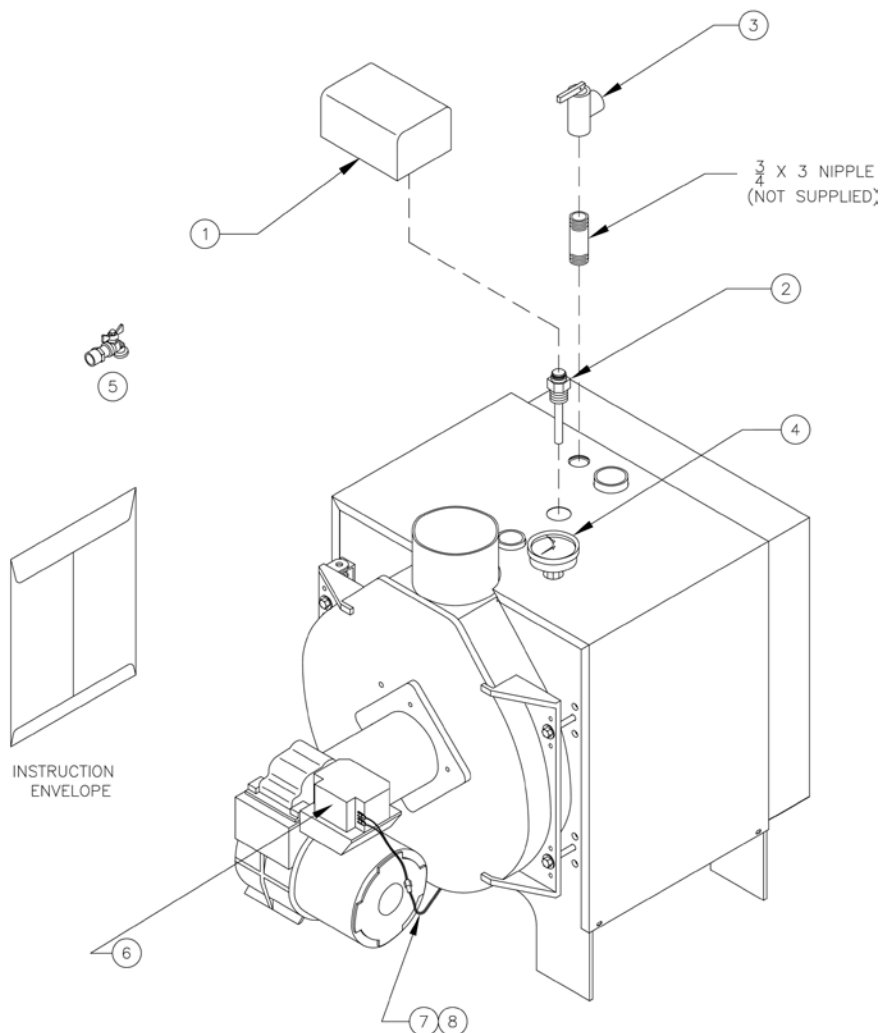
CAUTION: Do not start burner unless burner swing door is securely closed. Close door, install hex nuts, and tighten securely. Door should be parallel to tubesheet when viewed from top and sides. Reconnect two halves of Swing Door Interlock.

WARNING

The boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

V. Repair Parts

All LE™ Series Repair Parts may be obtained through your local Burnham Wholesale distributor. Should you require assistance in locating a Burnham Distributor in your area, or have questions regarding the availability of Burnham products or repair parts, please contact Burnham Customer Service at (717) 481-8400 or Fax (717) 481-8408.



Item	Description	Qty.	Part Number
1	Honeywell L7248C1014 High Limit & Circulator Relay --OR-- Honeywell L4080B1261 High Limit	1	100059-01 80160402
2	Honeywell 123871A, 3/4 NPT x 3	1	80160452
3	Conbraco 10-408-05, 3/4 FPT, 30 PSI Relief Valve	1	81660319
4	Temperature/Pressure Gauge 1-1/2 DIA (Long Shank)	1	8056164U
5	Conbraco 35-302-03, 3/4 FPT Drain Valve	1	806603061
6	Beckett R7184 Oil Primary Control	1	80160847
7	Burner Disconnect Harness	1	8133302
8	Strain Relief Bushing (Not Shown)	1	8136029

Figure 18: LE Boiler Trim & Controls

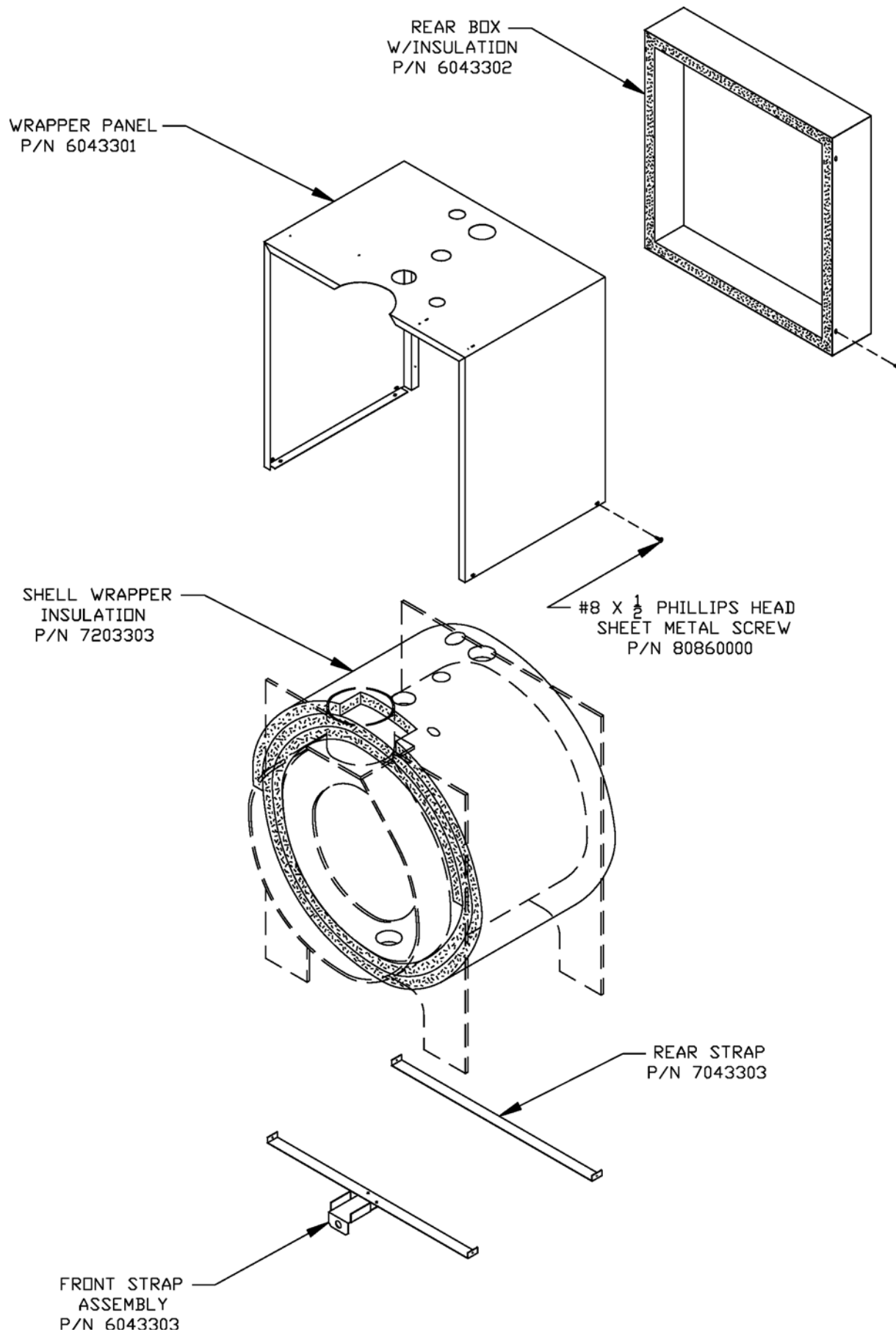


Figure 19: LE Boiler Jacket & Insulation

ITEM	DESCRIPTION	QTY.	PART NUMBER
1	SHELL ASSEMBLY	1	6303301
2	COMBUSTION CHAMBER LINER	1	8203305
3	TURBULATOR	14	7116039
4A	FRONT SWING DOOR (PAINTED)	1	6303305
4B	FRONT DOOR OUTER INSULATION	1	8203302
4C	FRONT DOOR OUTER ROPE GASKET	1	7203301
4D	FRONT DOOR INNER INSULATION	1	8203301
4E	FRONT DOOR AND FURNACE ROPE GASKET	1	7203305
4F	#6 X 1/2 DRIVE SCREW	2	80860718
5A	HINGE BRACKET	4	7022701
5B	HINGE SPACER	2	7303310
5C	HINGE PIN	2	80861614
5D	HAIRPIN COTTER	2	80861667
6A	REAR DOOR	1	8303302
6B	REAR DOOR INSULATION	1	8203303
6C	REAR DOOR ROPE GASKET	1	7203302
7	BRASS PIPE PLUG	1	808603596
8	1/2 - 18 X 1/2 CAP SCREW	4	80861304
9	1/2 - 18 X 1 CAP SCREW	4	80861307
10	1/2 - 18 X 3 CAP SCREW	2	80861361
11	FLAT WASHER	2	80860601
12	1/2 HEX NUT	12	80860403

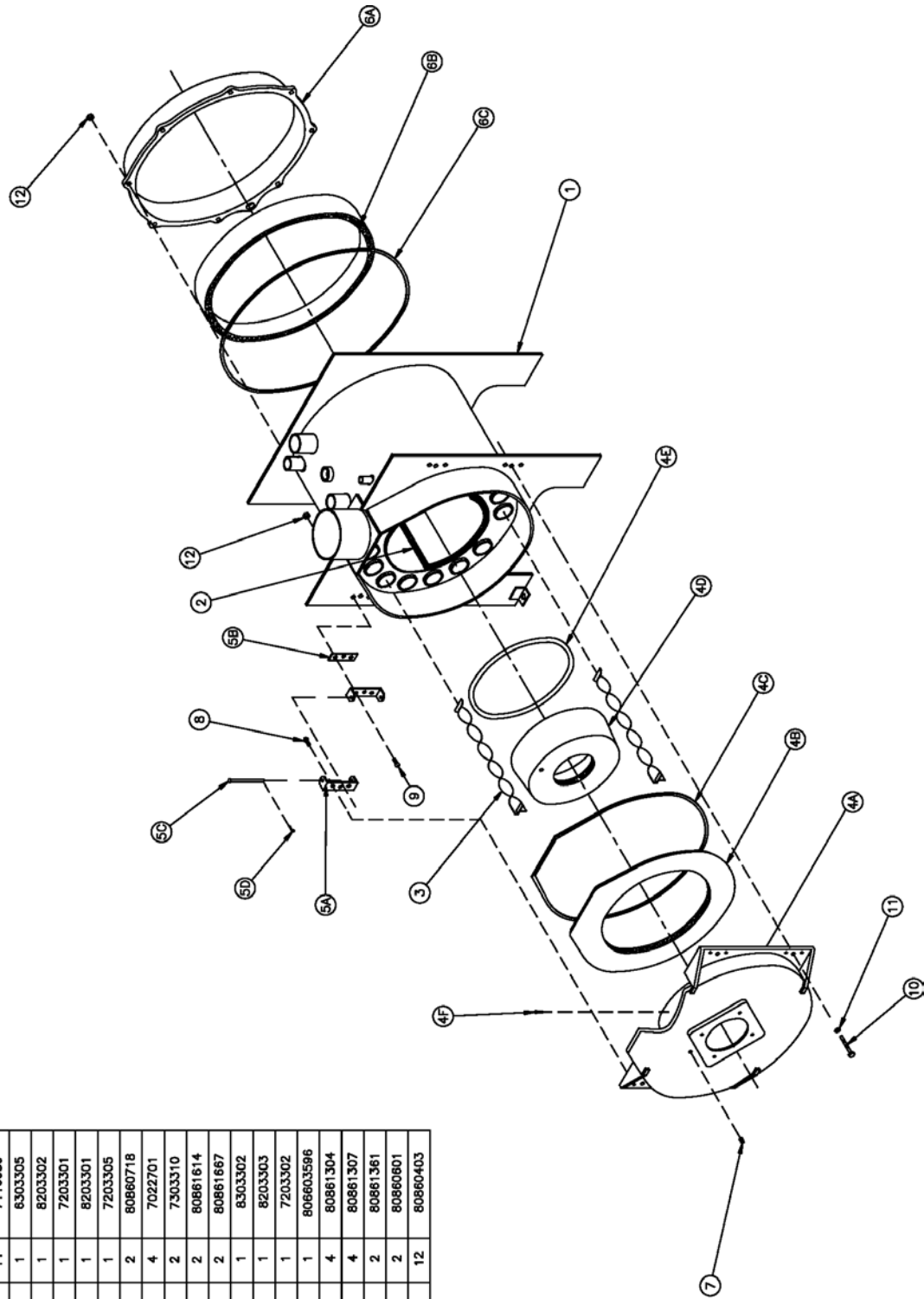
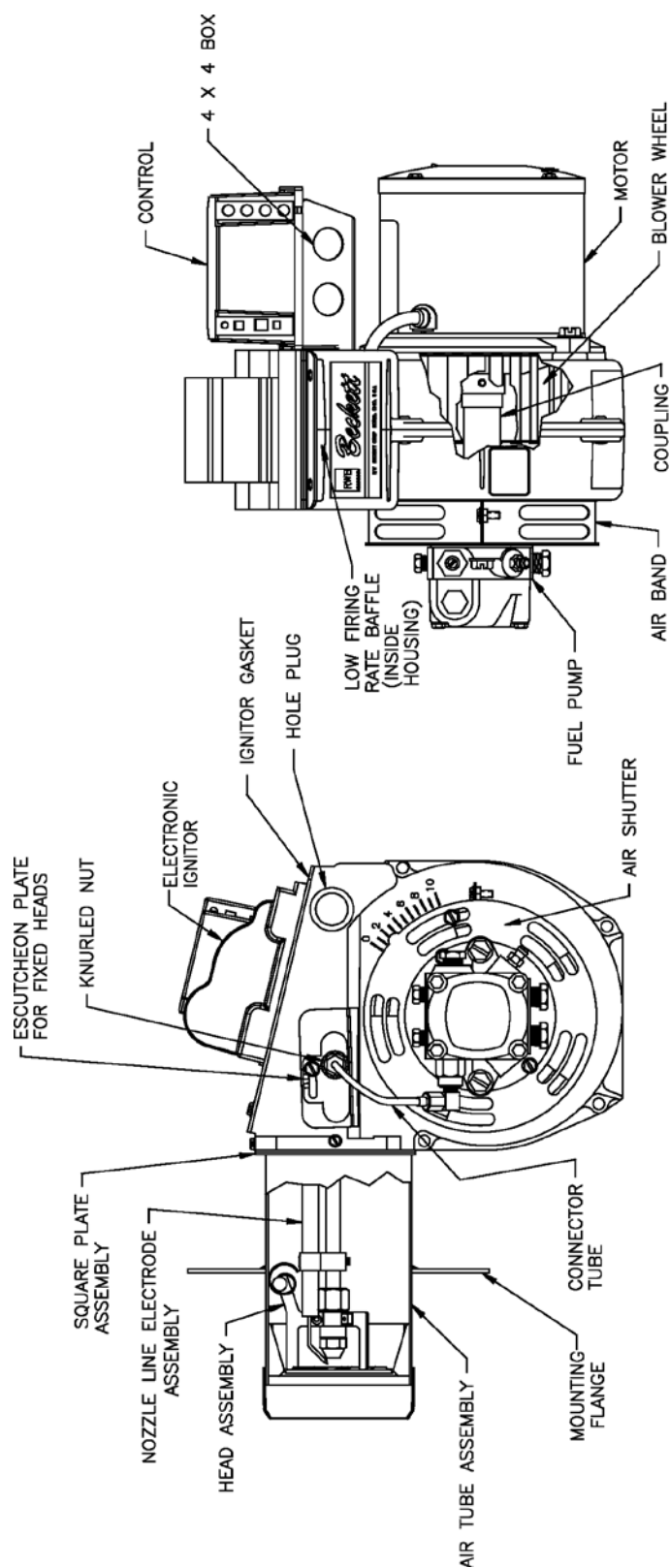
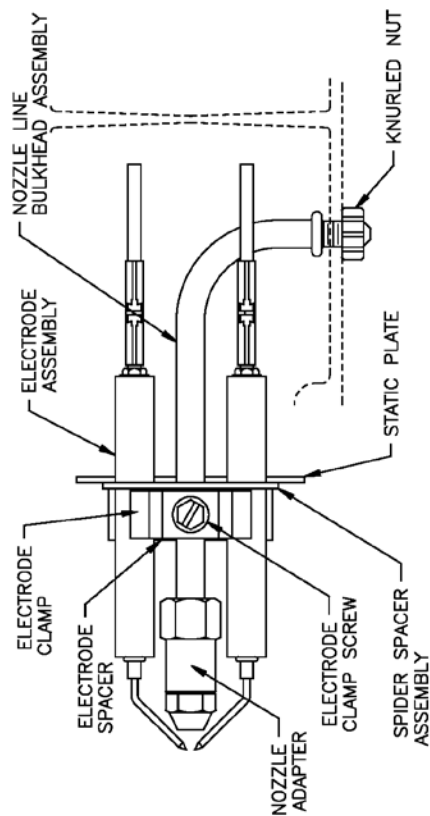


Figure 20: LE Bare Boiler Assembly



SIDE VIEW



NOZZLE DETAIL

FIGURE 21: BECKETT AFG OIL BURNER REPAIR PARTS

For replacement oil burner parts, contact your wholesaler or the burner manufacturer:

R.W. Beckett Co., P.O. Box 1289, Elyria, OH 44036 (440) 327-1060 (800) OIL BURN(645-2876) FAX (440) 327-1064

MODEL	LE1		LE2
Firing Rate (gph)	0.60	1.00	1.25
Spec No. Beckett	BCB4611		BCB4612
Air Tube Combination	AFG50MB		AFG50MD
Combustion Head Type	L1		V1
Air Band	3492BKA		
Air Shutter	3709BK		
Blower	2999		
Low Firing Rate Baffle Kit	5880	N/A	N/A
Knurled Nut Kit	51400		
Connector Tube Assembly	5636		
Coupling	2454		
Electrode Clamp	149		
Electrode Clamp Screw	4219		
Electrode Insulator Assembly	5940		
Spider Spacer Assembly	5655		5873
Escutcheon Plate	3493		5941
Gasket	31498		
Combustion Head	5912U		5913U
Hole Plug	2139		
Housing Ass'y w/Inlet Bell	5877		
Motor	2456		
Nozzle Adapter	213U		
Nozzle Line Electrode Assembly	NL50MB		NL50MD
Pump (Includes Valve)	21844		
Static Plate	3384		3383P
Ignitor	7440		
Transformer	5878U		
Ignitor/Transformer Gasket	51304		
Junction Box	5770		
Flame Detector	7006U		

SERVICE RECORD

DATESERVICE PERFORMED[illegible]

VI. Low Water Cut Off (LWCO)

WARNING

DO NOT ATTEMPT to cut factory wires to install an aftermarket Low Water Cut Off (LWCO). Only use connections specifically identified for Low Water Cut Off.

In all cases, follow the Low Water Cut Off (LWCO) manufacturer's instructions.

When

A low water cutoff is required to protect a hot water boiler when any connected heat distributor (radiation) is installed below the top of the hot water boiler (i.e. baseboard on the same floor level as the boiler). In addition, some jurisdictions require the use of a LWCO with a hot water boiler.

Where

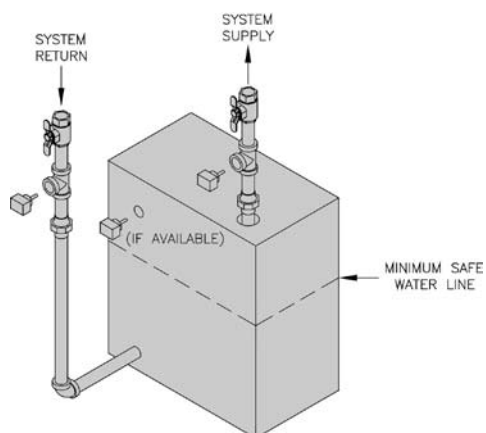
The universal location for a LWCO on both gas and oil hot water boilers is above the boiler, in either the supply or return piping. The minimum safe water level of a water boiler is at the uppermost top of the boiler; that is, it must be full of water to operate safely.

What Kind

Typically, in residential applications, a probe type LWCO is used instead of a float type, due to their relative costs and the simplicity of piping for a probe LWCO.

How to Pipe

A “tee” is commonly used to connect the probe LWCO to the supply or return piping, as shown below.



LWCO Location

Select the appropriate size tee using the LWCO manufacturer's instructions. Often, the branch connection must have a **minimum** diameter to prevent bridging between the probe and the tee. Also, the run of the tee must have a minimum diameter to prevent the end of the probe from touching or being located too close to the inside wall of the run of the tee. Ideally, manual shutoff valves should be located above the LWCO and the boiler to allow for servicing. This will allow probe removal for inspection without

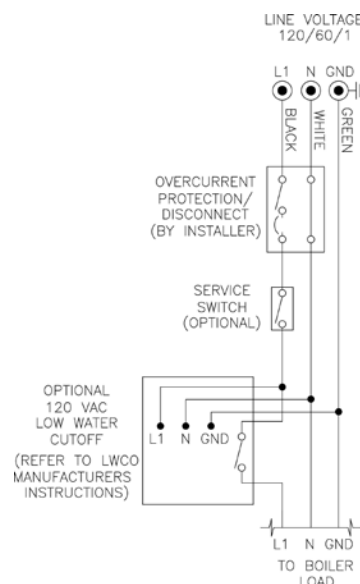
draining the heating system. Many probe LWCO manufacturers recommend an annual inspection of the probe.

How to Wire

LWCO's are available in either 120 VAC or 24 VAC configurations. The 120 VAC configuration can be universally applied to both gas and oil boilers by wiring it in the line voltage service to the boiler (after the service switch, if so equipped).

The presence of water in a properly installed LWCO will cause the normally open contact of the LWCO to close, thus providing continuity of the 120 VAC service to the boiler.

It is recommended to supply power to the probe LWCO with the same line voltage boiler service as shown below.



Wiring of Typical LWCO

A 24 VAC LWCO is used primarily for gas fired boilers where a 24 volt control circuit exists within the boiler. However, a 24 VAC LWCO can only be used if the boiler manufacturer has provided piping and wiring connections and instructions to allow for this application.

How to Test

Shut off fuel supply. Lower water level until water level is BELOW the LWCO. Generate a boiler demand by turning up thermostat. Boiler should not attempt to operate. Increase the water level by filling the system. The boiler should attempt to operate once the water level is above the LWCO.

Limited Warranty

FOR RESIDENTIAL GRADE WATER BOILERS

Subject to the terms and conditions set forth below, U.S. Boiler™ Co., Inc. Lancaster, Pennsylvania hereby extends the following limited warranties to the original owner of a residential grade water boiler manufactured and shipped on or after July 1, 1991:

ONE YEAR LIMITED WARRANTY ON RESIDENTIAL GRADE WATER BOILERS

U.S. Boiler Co., Inc. warrants to the original owner that its residential grade water boilers comply at the time of manufacture with recognized hydronic industry standards and requirements then in effect and will be free of defects in material and workmanship under normal usage for a period of one year from the date of original installation. If any part of a water boiler is found to be defective in material or workmanship during this one year period, U.S. Boiler Co., Inc. will, at its option, repair or replace the defective part.

LIFETIME LIMITED WARRANTY ON HEAT EXCHANGER

U.S. Boiler Co., Inc. warrants to the original owner that the heat exchanger of its residential grade water boilers will remain free from defects in material and workmanship under normal usage for the lifetime of the original owner at the original place of installation. If a claim is made under this warranty during the first ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option, repair or replace the heat exchanger. If a claim is made under this warranty after the expiration of ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option and upon payment of the pro-rated service charge set forth below, repair or replace the heat exchanger. The service charge applicable to a heat exchanger warranty claim is based upon the number of years the heat exchanger has been in service and will be determined as a percentage of the retail price of the heat exchanger model involved at the time the warranty claim is made as follows:

Years In Service	1-10	11	12	13	14	15	16	17
Service Charge as % of Retail Price	No Charge	5	10	15	20	25	30	35

Years In Service	18	19	20	21	22	23	24	25 and above
Service Charge as % of Retail Price	40	45	50	55	60	65	70	75

NOTE: If the heat exchanger model involved is no longer available due to product obsolescence or redesign, the value used to establish the retail price will be the published price as shown in the Burnham Hydronics Repair Parts Price Sheet where the heat exchanger last appeared or the current retail price of the then nearest equivalent heat exchanger.

ADDITIONAL TERMS AND CONDITIONS

- 1. Applicability:** The limited warranties set forth above are extended only to the original owner at the original place of installation within the United States and Canada. These warranties are applicable only to water boilers designated as residential grade by U.S. Boiler Co., Inc. and installed in a single or two-family residence and do not apply to steam boilers of any kind or to commercial grade boilers.
- 2. Components Manufactured by Others:** Upon expiration of the one year limited warranty on residential grade water boilers, all boiler components manufactured by others but furnished by U.S. Boiler Co., Inc. (such as oil burner, circulator and controls) will be subject only to the manufacturer's warranty, if any.
- 3. Proper Installation:** The warranties extended by U.S. Boiler Co., Inc. are conditioned upon the installation of the residential grade water boiler in strict compliance with U.S. Boiler Co., Inc. installation instructions. U.S. Boiler Co., Inc. specifically disclaims liability of any kind caused by or relating to improper installation.
- 4. Proper Use and Maintenance:** The warranties extended by U.S. Boiler Co., Inc. conditioned upon the use of the residential grade water boiler for its intended purposes and its maintenance accordance with U. S. Boiler Co., Inc. recommendations and hydronics industry standards. These warranties will be inapplicable

if the residential grade water boiler is used or operated over its rated capacity, is subjected to unauthorized modification, or is damaged as a result of being otherwise improperly operated or serviced including, but not limited to, damage from any of the following: operation with insufficient water, allowing the boiler to freeze, subjecting the boiler to flood conditions, and operation with unapproved water or fuel additives which cause deposits or corrosion.

5. Removal and Installation: These warranties do not cover expenses of removal or reinstallation. The owner is responsible for the cost of removing and reinstalling any defective part and its replacements and all labor and material connected therewith.

6. Exclusive Remedy: U.S. Boiler Co., Inc. obligation for any breach of these warranties is limited to the repair or replacement of its parts in accordance with the terms and conditions of these warranties.

7. Limitation of Damages: Under no circumstances shall U.S. Boiler Co., Inc. be liable for incidental, indirect, special or consequential damages of any kind whatsoever under these warranties, including, but not limited to, injury or damage to persons or property and damages for loss of use, inconvenience or loss of time. U.S. Boiler Co., Inc. liability under these warranties shall under no circumstances exceed the purchase price paid by the owner for the residential grade water boiler involved. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

8. Limitation of Warranties: These warranties set forth the entire obligation of U.S. Boiler Co., Inc. with respect to any defect in a residential grade water boiler and U.S. Boiler Co., Inc. shall have no express obligations, responsibilities or liabilities of any kind whatsoever other than those set forth herein. These warranties are given in lieu of all other express warranties.

ALL APPLICABLE IMPLIED WARRANTIES, IF ANY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED IN DURATION TO A PERIOD OF ONE YEAR EXCEPT THAT IMPLIED WARRANTIES, IF ANY, APPLICABLE TO THE HEAT EXCHANGER IN A RESIDENTIAL GRADE WATER BOILER SHALL EXTEND TO THE ORIGINAL OWNER FOR THE LIFETIME OF THE ORIGINAL OWNER AT THE ORIGINAL PLACE OF INSTALLATION. SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PROCEDURE FOR OBTAINING WARRANTY SERVICE

In order to assure prompt warranty service, the owner is requested to complete and mail the attached Warranty Card within ten days after the installation of the boiler, although failure to comply with this request will not void the owner's rights under these warranties.

Upon discovery of a condition believed to be related to a defect in material or workmanship covered by these warranties, the owner should notify the installer, who will in turn notify the distributor. If this action is not possible or does not produce a prompt response, the owner should write to U.S. Boiler Co., Inc., Burnham Hydronics, at P.O. Box 3079, Lancaster, PA 17604, giving full particulars in support of the claim.

The owner is required to make available for inspection by U.S. Boiler Co., Inc. or its representative the parts claimed to be defective and, if requested by U.S. Boiler Co., Inc. to ship these parts prepaid to U.S. Boiler Co., Inc. at the above address for inspection or repair. In addition, the owner agrees to make all reasonable efforts to settle any disagreement arising in connection with a claim before resorting to legal remedies in the courts.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

